# Changes in Health-Related Quality of Life in Older Patients with Acute Myocardial Infarction or Congestive Heart Failure: A Prospective Study

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**OBJECTIVES:** To study changes in health-related quality of life (HR-QL) following acute myocardial infarction (AMI) or congestive heart failure (CHF) in older people (≥57 yr).

**DESIGN:** Prospective cohort study.

**SETTING:** Primary healthcare registers.

**PARTICIPANTS:** Patients were enrolled on the basis of primary healthcare records. Eighty-nine AMI patients (mean age = 69.5) and 119 CHF patients (mean age = 74.5) were included for analysis.

**MEASUREMENTS:** HR-QL was conceptualized and measured by means of physical (activities of daily living (ADL), instrumental activities of daily living (IADL)), psychological (depressive symptoms, anxiety), social, and role functioning. Premorbid data (T0) were available from a 1993 community-based survey. Incident AMI and CHF cases, developed after 1993, were prospectively followed for 12 months. Assessments were performed at 6 weeks (T1) and 6 (T2) and 12 months (T3) after diagnosis.

**RESULTS:** At the premorbid assessment, AMI patients did not significantly differ on HR-QL from a reference group of older people, whereas CHF patients were on average older and had worse HR-QL compared to the reference group. Although CHF had not yet been diagnosed at T0, symptoms were already present and resulted in decreased levels of functioning. At T1, all HR-QL measures showed worse functioning compared with T0, except for depressive symptoms that presented later (at T2). In contrast to the delay in depressive symptoms, a significant increase in anxiety was already seen at T1. The effect of the somatic conditions was the largest on physical functioning. Effects on psychological and social functioning were less pronounced but still significant. Effects were maintained during the 12 months of follow-up.

**CONCLUSION:** The negative consequences on HR-QL in both AMI and CHF patients are not temporary. No recovery of function was seen in AMI patients, and functioning of CHF patients continued to decline in the first year after diagnosis. **J Am Geriatr Soc 49:1052–1058, 2001.**

**Key words: health-related quality of life; cardiovascular disease; older**

Cardiovascular diseases, including acute myocardial infarction (AMI) and congestive heart failure (CHF), are a major healthcare problem, especially with an aging population. Although, AMI is the result of progressive arteriosclerosis, a heart attack often takes patients by surprise. The mortality rate among patients with AMI is high and increases with age. The 1-year cardiac mortality rate is 12% for persons under age 75 and 18% for persons age 75 and older.[1] CHF is a pathophysiological disease characterized by the inability of the heart to pump blood at a rate commensurate with the requirements of the metabolizing tissues of the body. It is a common illness. The incidence is still increasing, both because of the aging of the population and the higher AMI survival rate. The prognosis for those with chronic CHF is poor, with a mortality rate as high as 30% within 1 year of onset of heart failure symptoms.[2] For those who survive, AMI and CHF may have considerable impact on functioning and well-being. The effects of both diseases might be similar, although some are disease specific. Persons who experience an AMI are suddenly confronted with a life-threatening event. The first heart attack comes unannounced and might provoke initial feelings of fear and despair. By contrast, CHF occurs

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less suddenly. Persons recently diagnosed as having CHF might have been suffering from dyspnea or fatigue for months. Although one might not be aware of the cardiovascular cause, the diagnosis of CHF generally comes as less of a shock compared with AMI.

Both AMI and CHF may be disabling diseases and complete functional recovery may be possible. Therefore, therapy serves two primary goals. The first is to prevent further progression of the disease or mortality and the second is to alleviate symptoms and suffering. Quantifying these latter variables requires the use of health-related quality of life (HR-QL) measures: questionnaires that elicit from patients the impact of their condition on their functioning, symptoms, and quality of life. Over the past decade, there has been a surge in the measurement of quality of life as an indicator of health outcome. Quality of life has been defined by the World Health Organization as "an individual's perception of their position in life, in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns."[3] HR-QL can be defined on the basis of several different viewpoints. It is a global construct and its operationalization (method of measurement) depends on the research question and study goal. However, many quality of life researchers agree that HR-QL is a multidimensional construct with at least three main domains, physical, psychological, and social functioning or well-being.

The objective of this study is to describe changes in three domains of HR-QL immediately after diagnosis of AMI or CHF. The change in quality of life after a cardiac event has been the subject of several studies,[4–6] but previous studies have several limitations, which this study has attempted to rectify. First, the present study is longitudinal, which is preferable to cross-sectional designs. The Medical Outcomes Study (MOS) has great scientific interest, yet it is limited by its cross-sectional design. The MOS compares HR-QL for several chronic conditions and shows that patients with AMI and CHF have the poorest HR-QL when compared with patients with diabetes mellitus, chronic lung problems, gastrointestinal disorders, or arthritis.[7] Second, community-based data are preferable to trials including selected patient groups. Few longitudinal studies on changes in HR-QL in patients with either AMI or CHF have been performed, and most previous trials focus on treatment or cardiac rehabilitation effects.[4] These trials reflect the highly selected group of patients that enter clinical trials. Cross-sectional data or results from clinical trials are not the first choice when one is interested in HR-QL following AMI or CHF in general. Third, most studies focus on one single aspect of HR-QL (e.g., on psychological well-being or on physical functioning only). Because HR-QL is a multidimensional construct, it is preferable to study several domains of HR-QL, as does the present study. Fourth, we have included data on AMI and CHF patients. This enables us to compare the patterns of change in HR-QL domains for an acute (AMI) and a chronic (CHF) heart condition. From a theoretical point of view, the acute condition, AMI, and the more chronic condition, CHF, might produce different patterns of changes in HR-QL domains. It is expected that physical functioning decreases immediately after the occurrence of an AMI and that some recovery takes place in the following months. By contrast, less dramatic changes are expected in patients with a recent diagnosis of CHF because this is a more chronic disease.

The focus of this paper is on the effects of AMI or CHF on physical, psychological, and social functioning in a sample of older adults, drawn from primary healthcare registers. The following questions are explored in this study: To what extent does AMI or CHF affect HR-QL domains? Are the intensity and timing of changes comparable for the three domains? Is any recovery in HR-QL seen in the 12 months following diagnosis? The present study is unique, because we not only examine HR-QL after AMI and in recently diagnosed CHF patients but also include data on the premorbid HR-QL status in our analysis. This allows us to compare the situation after AMI or CHF with the premorbid situation, that is, with a point in time when patients were not yet suffering from the specified heart condition.

## METHODS

This study is part of the Groningen Longitudinal Aging Study (GLAS), a population-based prospective follow-up study of the determinants of disease, functional disability, well-being, and utilization of care in older persons.[8–12]

### Baseline Participants

The study population comprised 8,723 persons age 57 and older on January 1, 1993, who were registered as patients with the 27 general practitioners participating in the Morbidity Registration Network Groningen. A total of 152 persons had died or left the practice by the time the contact was made, leaving 8,571 eligible persons. Useful baseline data were available for 5,279 subjects (62% of 8,571 eligible older persons). The GLAS baseline assessment was carried out in 1993 and consisted of an interview and a questionnaire sent by mail. With respect to subject nonresponse bias, nonresponse was not random but was associated with higher age and with female gender. Objectives, design, and matters of representativeness of the GLAS study have been described elsewhere.[8,9] The results showed no evidence of nonresponse bias relevant to the issues addressed in our study.

### Inclusion Criteria

From the baseline wave in 1993 until January 1, 1998, the general practitioners provided the names of all patients with a new post-baseline episode or diagnosis of AMI or CHF according to the criteria of the International Classification of Primary Care (ICPC).[13] AMI was diagnosed if two of the following three findings were present: (1) chest pain characteristic of myocardial ischemia and lasting more than 15 minutes, (2) abnormal ST-T changes or Q waves on an electrocardiogram, or (3) elevation of blood cardiac enzymes (code K75 of ICPC). For those persons with AMI who did not present with chest pain, the other two abnormalities had to be present to allow a diagnosis of AMI. CHF was diagnosed if three of the following five clinical manifestations were present: (1) dependent edema, (2) raised jugular venous pressure or hepatomegaly in the absence of liver disease, (3) signs of pulmonary congestion or pleural effusion, (4) enlarged heart, and (5) dyspnea in the absence of pulmonary disease (code K77 of ICPC). Twenty-eight patients experienced both a new episode of AMI and first diagnosis of

CHF, in 19 cases CHF diagnosis preceded AMI, and in nine cases AMI occurred before CHF. For these cases, only data of the first diagnosed episode are included in this study.

### Assessment Points

All outcome variables were assessed on four occasions: at baseline (T0: premorbid) and 6 weeks (T1), 6 months (T2), and 12 months (T3) after diagnosis. The premorbid assessment took place in 1993 for all participants, whereas the timing of T1, T2, and T3 depended on the time of diagnosis and occurred between 1993 and 1998. The mean length of the time interval between the baseline interview and the new episode was 27 months for AMI and 26 months for CHF and ranged from 1 to 58 months.

### Patients

During the enrollment period, 207 patients with a new episode of AMI and 293 patients with a first diagnosis of CHF after baseline were recruited. Of the 207 persons with AMI, 49 (24%) died before T1 and 16 were already participating in one of the other six GLAS cohort studies. Of the 142 potential responders, 23 refused participation in the study and 19 did not participate for other reasons, leaving 100 for T1 (70%). Of these 100 AMI patients who started the follow-up study, 93 (93%) participated in T2 and 89 (89%) also completed T3. Of the 293 persons with CHF, 25 (8.5%) died before T1 and 33 were already participating in another GLAS cohort study. Of the 235 potential responders, 45 refused participation and 28 did not participate for other reasons. Of the 162 CHF patients who started with the follow-up study, 136 (84%) participated in T2 and 119 (73%) also completed T3. Nonresponse analyses showed that, at baseline (T0), responders were significantly younger and had better physical functioning scores, on average, than nonresponders.

### Outcome Measures

HR-QL is conceptualized as relating to three domains of functioning: physical, psychological, and social.

Physical functioning is assessed with the Groningen Activity Restriction Scale (GARS). GARS comprises 18 ADL (activities of daily living) and IADL (instrumental activities of daily living) items, each with four response categories. Scores may range from 18 (no physical dysfunctioning) to 72 (maximum level of dysfunctioning). Examples of GARS items are "Can you dress yourself without any help from others?" and "Can you walk up and down the stairs?" The results of previous studies showed that GARS meets the stochastic cumulative scalability criteria of the Mokken Model.[14,15]

Depressive symptomatology and anxiety, indicators of psychological functioning, were assessed with the Hospital Anxiety and Depression Scale (HADS).[16,17] Items referring to symptoms that may have a physical cause (e.g., insomnia and weight loss) are not included in the scale. Therefore, HADS is considered to have no bias towards depressive symptoms resulting from concurrent general medical conditions.[17] Examples of items are "I still enjoy the things I used to enjoy." "I feel as if I am slowed down." Both subscales consist of seven items and the theoretical ranges vary from 0 to 21; higher scores indicate more symptoms. HADS has been validated for an older Dutch population.[17]

Social functioning is assessed with two MOS subscales: MOS social functioning and MOS role functioning.[18] The social functioning subscale measures the extent to which health interferes with normal social activities such as visiting friends in a one-item question. The role functioning subscale measures the extent to which health interferes with usual daily activities such as housework or paid work. Both scales range from 0 to 100. Scores are reversed so that higher scores indicate poorer functioning, corresponding with scores on physical and psychological functioning. The psychometric properties of the Dutch version of the MOS scales were approved in a pilot study.[19]

### Analysis

Baseline characteristics of patients were compared with a reference group (i.e., all the GLAS baseline participants except those who developed AMI or CHF), to study any differences in HR-QL at baseline (adjusted for age, gender, and marital status differences). Changes in the three HR-QL domains are presented in graphs showing the means and 95% confidence intervals (CI) at each assessment point. Changes between two assessment times are tested for statistical significance with paired sample *t*-tests and the magnitude of changes is quantified by calculating effect sizes using Cohen's method.[20] Effect sizes are calculated by dividing the mean change over a period by the standard deviation (SD) of that change. An effect size of .20 indicates a small effect, an effect size of .50 a medium effect and .80 indicates a large effect.[20] In addition, analysis on individual patient level was included by calculating the percentage of patients with a substantial deterioration in HR-QL. The definition of this change was deduced from Cohen's effect sizes. According to Cohen, an effect size $\geq$.80 indicates a large change, which corresponds to a change of at least 0.8 $\times$ SD. A large change, for each period, was defined as a change larger than 0.8 $\times$ SD (i.e., the SD of the change between T0 and T1).

## RESULTS

### Patient Characteristics

Table 1 shows the premorbid characteristics of the patient groups and a reference group. Data on premorbid characteristics were collected during the same period and in the same study for all groups. The reference group consisted of 4,802 GLAS participants who did not develop AMI or CHF between 1993 and 1998. Compared with the reference group, the percentage of female AMI patients was low, whereas CHF patients were significantly older and more often lived without a partner. Comparisons of premorbid HR-QL scores were adjusted for these differences in age, gender, and marital status. There were no significant differences in premorbid HR-QL between AMI patients and the reference group, but CHF patients had more depressive symptoms and poorer social functioning and role functioning compared with the reference group ($P <$ .05) (see Table 1). Unadjusted premorbid physical functioning in CHF patients was significantly worse compared with the AMI or reference groups but was not statistically significant after adjusting for age, gender, and marital status. Comparisons of psychological and social functioning in the AMI and CHF groups showed slightly poorer psy-

**Table 1. Characteristics of a Reference Group and Premorbid Characteristics of AMI, CHF Patients***

| Parameter | Reference group (n = 4,802) % | | AMI (n = 89) % | | | CHF (n = 119) % | | |
|---|---|---|---|---|---|---|---|---|
| Females | 57 | | 34† | | | 59 | | |
| Without partner | 32 | | 27 | | | 45† | | |
| Educational level | | | | | | | | |
| Low | 3 | | 4 | | | 3 | | |
| Moderate | 86 | | 87 | | | 87 | | |
| High | 11 | | 9 | | | 10 | | |
| | Mean | (SD) | Mean | Adj.‡ | (SD) | Mean | Adj.‡ | (SD) |
| Age (yrs) | 69.2 | (7.9) | 68.5 | — | (7.2) | 74.5† | — | (7.2) |
| Physical functioning | 22.8 | (7.9) | 22.0 | 22.5 | (5.6) | 25.7† | 23.8 | (9.0) |
| Anxiety | 3.9 | (3.6) | 3.8 | 4.1 | (3.8) | 3.9 | 4.0 | (3.6) |
| Depressive symptoms | 4.3 | (3.5) | 4.5 | 4.6 | (3.5) | 5.6† | 5.3§ | (4.0) |
| Social functioning | 18.2 | (25.2) | 19.1 | 20.6 | (24.6) | 29.4† | 25.1§ | (30.0) |
| Role functioning | 24.9 | (40.6) | 26.1 | 28.4 | (40.1) | 46.2† | 39.9§ | (47.4) |

*The reference group includes the baseline participants of the GLAS study minus the 477 patients who developed AMI or CHF between 1993 and 1998. On all HR-QL measures, higher scores indicate poorer functioning.
†Statistically significant difference with reference group ($P < .05$, unadjusted).
‡Adjusted means are adjusted for age, gender, and marital status, according to distributions in reference group.
§Statistically significant difference between adjusted means in CHF and reference group ($P < .05$). Differences in adjusted means between AMI and reference group, and between AMI and CHF group were not statistically significant.
AMI = acute myocardial infarction; CHF = congestive heart failure; SD = standard deviation; HR-QL = health-related quality of life; GLAS = Groningen Longitudinal Aging Study.

chosocial functioning in the CHF group, but the adjusted (premorbid) differences were not statistically significant.

### Physical Functioning

Figure 1 shows the change in physical functioning, expressed as GARS score, in AMI and CHF patients. In AMI patients, mean physical functioning during follow-up changed from 22.0 (T0) to 25.9 (T1), 25.4 (T2), 25.8 (T3) and in CHF patients from 25.7 to 30.7, 32.1, 32.1, respectively. Six weeks after diagnosis (T1), physical functioning was worse for both cohorts in comparison with premorbid levels. Six and 12 months after diagnosis (T2 and T3), the level of physical functioning remained worse and did not return to premorbid levels. The change in physical functioning from premorbid to 6 weeks after diagnosis (T0–T1) was statistically significant in both patients groups, and for CHF patients the mean change between T1 and T3 was also significant (paired sample *t*-test $P < .05$, see Table 2).

### Psychological Functioning

In AMI patients, mean levels of anxiety changed from 3.8 (T0) to 5.3 (T1), 5.1 (T2), 5.1 (T3) and in CHF patients from 3.9 to 4.6, 4.6, 5.2, respectively. Patients who developed AMI or CHF reported significantly higher levels of anxiety after diagnosis compared with premorbid data (see also Table 2). After 12 months, mean levels of anxiety were still elevated compared with premorbid levels. Just after diagnosis, patients did not seem to experience higher levels of depressive symptoms, but 6 and 12 months later an increase in depressive symptoms was observed in both patients groups. Mean levels of depressive symptoms were 4.45, 4.5, 5.4, and 5.4 in AMI and 5.6, 5.4, 6.0, and 6.1 in CHF patients, respectively.

### Social and Role Functioning

In AMI patients, mean social functioning changed from 19.1 (T0) to 35.0, 32.2, and 31.3 and mean role functioning changed from 26.1 to 53.4, 48.2, and 46.4. In CHF patients means were 29.4, 41.7, 35.7, and 39.8 for social functioning and 46.2, 54.8, 58.7, and 63.5 for role functioning, respectively. Both social functioning and role functioning worsened significantly 6 weeks after diagnosis (see also Table 2). The onset effect (T0–T1) on role functioning was more pronounced in the AMI group than in the CHF group, whereas the decline in role functioning between T1 and T3 was significant only for CHF patients. Social func-

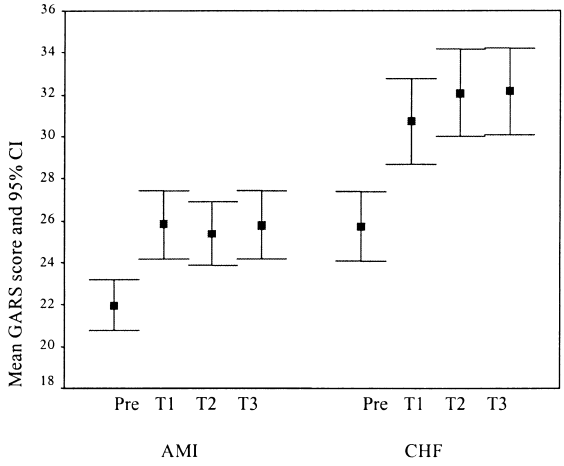


**Figure 1.** Change in physical functioning after AMI or CHF.

tioning and role functioning did not return to premorbid levels after 6 or 12 months but remained worse than T0 levels.

### Effect Sizes

The changes between T0 and T1, T1 and T3, and T0 and T3 and their effect sizes are summarized in Table 2. The changes between T2 and T3 are rather small and T2 assessments are not included in the table for reasons of comprehensiveness. The change between T0 and T1 represents the difference between premorbid functioning and functioning immediately after diagnosis (the onset effect). The largest effect sizes, both for AMI and CHF patients, were found for physical functioning (ES = .70 and .71, respectively). A moderate onset effect was found for anxiety. The onset effect for anxiety was more pronounced in AMI patients than in CHF patients (ES = .34 in AMI and .20 in CHF patients). No obvious onset effects for depressive symptoms were found (ES < .20). As for social functioning, small effect sizes were found in both AMI and CHF patients, whereas an onset effect for role functioning was found only in AMI patients (ES = .53) and was minimally measurable in CHF patients (ES = .19). Comparing the onset effects of AMI and CHF on HR-QL aspects showed comparable effects for both diseases, with the exception of the effect on role functioning, which was more pronounced after AMI than after CHF. This also held to a lesser extent for anxiety. The baseline situation (T0) of CHF patients was already worse on several HR-QL domains compared with the reference group or the AMI group but, nevertheless, worsened further after diagnosis.

Table 2 also shows the changes and their effect sizes between T1 and T3 (the difference between functioning 6 weeks after diagnosis and 1 year later (i.e., illness course effect)). Interestingly, HR-QL of patients with AMI or CHF did not change much in the year following diagnosis, compared with the change in HR-QL directly after diagnosis. Illness course effect sizes did not exceed .28, indicating nonsignificant or small effect sizes. However, two things are worth mentioning. First, although no onset effect (T0–T1) for depressive symptoms was seen, an increase in depressive symptomatology was observed in the year following diagnosis (T1–T3). In both AMI and CHF patients, the effect size was small but evident (ES > .20). Second, physical functioning and role functioning declined slightly (ES > .20) in patients with CHF, whereas no T1–T3 effect was measured in AMI patients.

The lower section of Table 2 shows the total effect over time of AMI or CHF, comparing functioning after 1 year with the premorbid situation (T0–T3). These data indicate a large effect for physical functioning, which was more pronounced in CHF patients (ES = .90) than in AMI patients (ES = .68). In comparison with premorbid data, medium effects for anxiety, social functioning, and role functioning were found (.20 < ES < .50). The total effect over time for depressive symptoms was small in AMI (ES = .24) and not evident in CHF patients (ES = .11).

Changes at the individual patient level are also presented in Table 2, to contrast with changes at the group level as discussed above. These results show large differences between patients. Consecutively, we present the percentage of patients

**Table 2. Change in HR-QL Parameters in Patients with AMI or CHF**

| | AMI (n = 89) | | | CHF (n = 119) | | |
|---|---|---|---|---|---|---|
| | Mean change* | ES* | % of patients with substantial deterioration† | Mean change* | ES* | % of patients with substantial deterioration† |
| Onset effect (T0–T1) | | | | | | |
| Physical | 3.9‡ | .70 | 43 | 5.0‡ | .71 | 41 |
| Anxiety | 1.5‡ | .34 | 32 | 0.7‡ | .20 | 30 |
| Depressive symptoms | 0.1 | .01 | 20 | −0.2 | .06 | 19 |
| Social | 15.9‡ | .42 | 39 | 12.3‡ | .39 | 24 |
| Role | 27.3‡ | .53 | 44 | 8.6‡ | .19 | 23 |
| Illness course effect (T1–T3) | | | | | | |
| Physical | −0.1 | −.06 | 10 | 1.4‡ | .28 | 24 |
| Anxiety | −0.2 | −.02 | 18 | 0.6‡ | .19 | 25 |
| Depressive symptoms | 0.9‡ | .25 | 29 | 0.7‡ | .22 | 22 |
| Social | −3.7 | −.11 | 13 | −1.9 | −.07 | 11 |
| Role | −7.0 | −.16 | 20 | 8.7‡ | .22 | 23 |
| Total effect over time (T0–T3) | | | | | | |
| Physical | 3.8‡ | .68 | 54 | 6.4‡ | .90 | 52 |
| Anxiety | 1.3‡ | .35 | 29 | 1.3‡ | .32 | 35 |
| Depressive symptoms | 0.9‡ | .24 | 29 | 0.5 | .11 | 31 |
| Social | 12.1‡ | .42 | 26 | 10.4‡ | .37 | 19 |
| Role | 20.3‡ | .41 | 35 | 17.3‡ | .37 | 31 |

*Positive changes and effect sizes (ES) indicated deteriorating functioning for all parameters.
†Patients with a deterioration of at least 0.8 × SD were counted. The SD of changes between T0 and T1 was comparable in both groups. This resulted in the following cut-off points: change in physical functioning ≥5; change in anxiety ≥3; change in depressive symptoms ≥3; change in social functioning ≥40; and change in role functioning ≥50.
‡Statistically significant change, i.e., paired sample *t*-test $P < .05$.
AMI = acute myocardial infarction; CHF = congestive heart failure; SD = standard deviation.

whose HR-QL deteriorated by at least 0.8 × SD. About half or more of the patients did not change more than 0.8 × SD and were categorized as "relatively stable" patients. A minority of patients showed an improvement on HR-QL aspects following AMI or CHF. As many as 19% to 54% of patients showed a deterioration in HR-QL aspects between T0 and T3. Some differences between AMI and CHF patients were noticed. For CHF patients, the impact on physical functioning was most pronounced. Between T0 and T3, as many as 52% of the CHF patients reported a deterioration in physical functioning. Baseline scores indicated that this group had poorer physical functioning to begin with, but it became even worse. The onset effect (between T0 and T1) on role functioning was more pronounced in AMI patients than in CHF patients (44% and 23% of patients, respectively, reported a deterioration in functioning, $P = .003$).

## DISCUSSION

The present study focuses on changes in three domains of HR-QL following a diagnosis of AMI or CHF. Large effects, measured on the basis of effect size, were seen for physical functioning in both patient groups. This is not surprising because both cardiovascular diseases are known for their large somatic consequences.

Physical functioning, measured with GARS, declined immediately after diagnosis and deteriorated even further in CHF patients in the following 12 months. At 6 weeks, follow-up mean scores for physical functioning had increased from 22 (premorbid) to 26 in AMI patients and from 26 to 31 in CHF patients. This increase of 4 and 5 points, respectively, indicates that on average patients experienced slightly more problems in 4 or 5 of the 18 activities, or a lot more problems in at least two activities. Comparing the means with other patient groups shows that the physical functioning of CHF patients is on average as poor as that of patients who have had rheumatoid arthritis for at most 4 years (mean scores 32.5).[21]

Effects on psychological and social functioning were less pronounced, but nevertheless significant. In both patient groups, an increase in anxiety was observed immediately after diagnosis, whereas an increase in depressive symptoms specifically was observed at 6 months. The first psychological reaction to AMI and CHF is expressed as anxiety, whereas depressive symptoms develop at a later stage. Compared with premorbid levels, 29% of AMI patients showed a substantial increase in depressive symptoms at 12 months (≥0.8 × SD), compared with 31% of CHF patients. Often psychological disturbance, particularly depression, in the presence of physical illness is regarded as understandable and therefore not of great clinical importance. This is an erroneous conclusion, because there is substantial evidence that untreated psychological comorbidity contributes significantly to overall morbidity, mortality, and cost of health care.[22] Feelings of anxiety and depression at 1-year follow-up were higher than premorbid levels. Premorbid data in the CHF group showed a relatively high level of depressive symptoms compared with AMI patients and the reference group, even after adjustment for age differences. A possible explanation for this finding might be that CHF is not a sudden event; symptoms of cardiac dysfunctioning might have been present for some time. Clearly, premorbid HR-QL aspects of AMI patients were not different from the reference group, whereas CHF patients already had a poorer HR-QL on all aspects except feelings of anxiety.

Most studies reporting on change in HR-QL in AMI or CHF patients were part of a clinical trial comparing treatments or rehabilitation programs. As a consequence, most of these studies included patients selected from the hospital. However, it is common knowledge that patients who participate in trials are a select group likely to be free of major comorbidity. Changes measured in these patients might differ from changes in a more community-based sample. The present study can be considered community-based. Patients were not selected from hospital records, as in most studies, but from general practitioners' primary healthcare records. Because 99% of the Dutch population is registered in a primary care setting and most patients will contact their primary care physician in the event of AMI or CHF, this study may be considered community based.

### Limitations of the Study

An important advantage of the present study is the comparison with premorbid conditions. However, a few remarks should be made concerning this point. First of all, premorbid data were collected in 1993 during a population survey. Incident cases of AMI and CHF were included in the study from 1993 to 1998. The timing of the three follow-up measurements depended on the time of diagnosis. As a consequence, the period between the premorbid measurement and T1 ranged from 1 month up to 58 months, averaging 27 months for the AMI group and 26 months for the CHF group. The difference in functioning between T0 and T1 is therefore not only due to AMI or CHF. The effects of aging and other morbidity might also be of influence. As the period between T0 and T1 increased, the influence of aging and other morbidity might also have increased. Some caution is needed when interpreting the changes in HR-QL as being solely due to AMI and CHF.

In our study, nonresponse could occur at three phases: before the baseline assessment, after diagnosis (before T1), and during follow-up. Although careful nonresponse analyses are performed, a response bias cannot be excluded. The nonresponse analyses showed that the study participants were younger, more often male, and had better baseline physical functioning and less comorbidity compared with nonresponders. Even in these somewhat less severely limited patients, effects on HR-QL were substantial; the effects might even be larger for the total patient population.

Our study does not include longitudinal data of the reference group, which may show changes in HR-QL irrespective of AMI and CHF. Because a population age 57 and older was followed longitudinally, aging effects might also have influenced changes in HR-QL. In the baseline reference group, aging was significantly correlated with a decline in HR-QL. A positive linear association was found for depressive symptoms and age. Quadratic associations were seen for other aspects of HR-QL, showing larger effects for the higher age groups. The mean age of CHF patients was 6 years higher than of AMI patients; therefore aging might have influenced results for the CHF group particularly. For the reference group, we calculated the mean aging effect for persons age 75 years (i.e., CHF group). We found that, per year, these individuals' physi-

cal functioning deteriorated by a score of 0.5; deterioration was less than 0.1 for anxiety and depression, 1.0 for social functioning, and 2.0 for role functioning. The effects of AMI and CHF were much larger; therefore we concluded that aging effects, although present, were of minor importance to the results.

### Implications of the Study

The data clearly suggest that the negative consequences of both AMI and CHF are not temporary. Immediately after diagnosis, poorer HR-QL was observed, and no significant improvement was measured in the 12 months after the diagnosis on any of the HR-QL variables for both groups. For CHF, a chronic debilitating illness, it is understandable that functioning remains affected in the long-term. However, it was striking that HR-QL in CHF patients continued to deteriorate over the course of the follow-up. For AMI, we expected the onset effect on HR-QL to be large, followed by some improvement after a number of months. However, the results showed no improvement in HR-QL during follow-up. Especially when small changes during the 12 months of follow-up were compared with the premorbid situation, it was obvious that these improvements were only minimal.

Our results underscore that the consequences of AMI and CHF are multidimensional and suggest that the multidimensional aspects should be included in treatment. In addition, the impact on HR-QL is somewhat different for AMI and CHF. In particular, the impact in CHF patients is more severe. The observation that the first psychological reaction to AMI and CHF is expressed as anxiety, whereas depressive symptoms develop at a later stage is important for clinical practice.

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